Active Project (2011 - 2017)

Conformal Ablative TPS Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)

ANTICIPATED BENEFITS

To NASA funded missions:

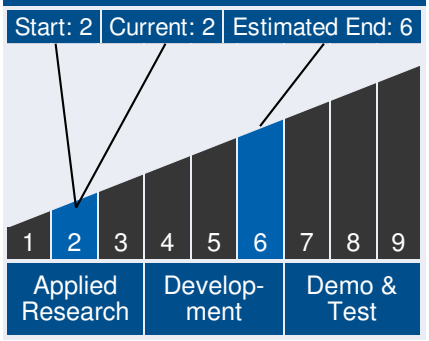
CA-TPS provides a lower cost, mass efficient solution that is easier to integrate due to the compliant and conformal nature of the material. CA-TPS can be used as a heat shield TPS for missions that will encounter peak heat flux ~500 W/cm2, peak pressures around 0.4 atm, and shear up to 500 Pa. Conformal ablator makes integration much easier for the back shell where geometric complexities such as penetrations and protrusions often requires expensive integration procedures.

DETAILED DESCRIPTION

CA-TPS is enabling small businesses and universities with low cost access to space by using off-the-shelf broad goods and transferring the processing technology for a light weight TPS. Use of CA-TPS materials will allow future missions to Mars, Venus and Outer Planets to save both mass and cost.

Table of Contents

Technology Maturity



Management Team

Program Executive:

- Lanetra Tate

Program Manager:

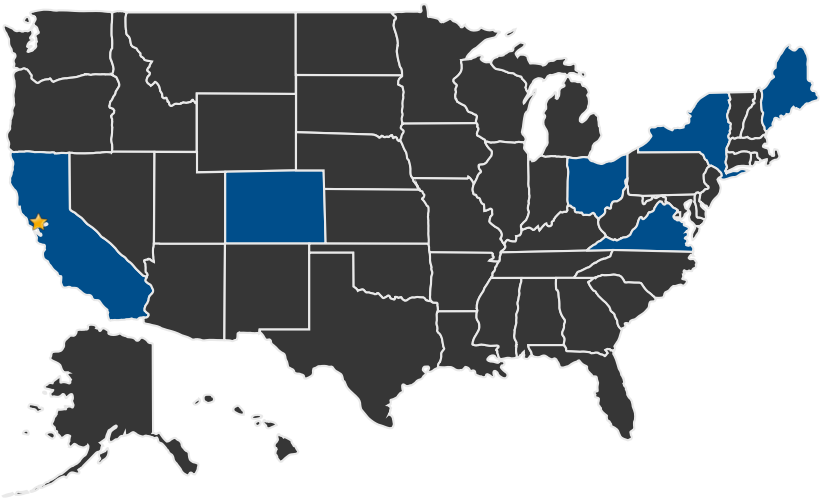
- Mary Wusk

Continued on following page.

Conformal Ablative TPS Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Ames Research Center

Other Organizations Performing Work:

- Applied Research Associates, Inc.
- Terminal Velocity Aerospace, LLC (Atlanta, GA)

Management Team *(cont.)*

Project Manager:
- Ethiraj Venkatapathy

Principal Investigator:
- Michelle Munk

Co-Investigator:
- Ronald Chinnapongse

Technology Areas

Primary Technology Area:
Entry, Descent, and Landing Systems (TA 9)
- Aeroassist and Atmospheric Entry (TA 9.1)
  - Thermal Protection Systems for Rigid Decelerators (TA 9.1.1)
    - Conformal Ablative Thermal Protection System (TPS) (TA 9.1.1.3)
    - Conformal Ablative Thermal Protection System (TPS) (TA 9.1.1.3)

Secondary Technology Area:
Thermal Management Systems (TA 14)
- Thermal Protection Systems (TA 14.3)
  - Ascent/Entry TPS (TA 14.3.1)
    - Flexible/Deployable Thermal Protection System (TA 14.3.1.3)

Continued on following page.

Technology Areas *(cont.)*

Additional Technology Areas:

- Thermal Management Systems (TA 14)
  - Thermal Protection Systems (TA 14.3)
    - Ascent/Entry TPS (TA 14.3.1)
      - Flexible/Deployable Thermal Protection System (TA 14.3.1.3)

DETAILS FOR TECHNOLOGY 1

Technology Title

Conformal Ablative TPS (CA-TPS)

Technology Description

This technology is categorized as a material for unmanned spaceflight

The goal of the CA-TPS Project is to develop and deliver a TRL 5-6 conformal TPS capable of at least 250 W/cm^2 for missions such as MSL, Commercial Off-the-Shelf (COTS) missions, or for the back shell on high energy planetary entry systems. The project has successfully tested materials in aerothermal environments above 500 W/cm^2. CA-TPS is a felt based technology, using commercially available, off the shelf products and currently established industrial manufacturing processes including aerospace grade rayon based felt and phenolic infusion. A conformal TPS over a rigid aeroshell has the potential to solve a number of challenges faced by traditional rigid TPS materials such as tiled Phenolic Impregnated Carbon Ablator (PICA) system on Mars Science Laboratory (MSL) and honeycomb based Avcoat on the Orion Multi-Purpose Crew Vehicle (MPCV). The compliant (high strain-to- failure) nature of the conformal ablative materials allows a much easier integration of the TPS to the underlying aeroshell structure and enable a monolithic-like configuration with larger segments (or parts) to be used. By reducing the overall part count, the cost of installation (based on cost comparisons between blanket and tile materials on shuttle) should be significantly reduced.

Capabilities Provided

High strain-to-failure, 500 W/cm2, 0.4 atm, 500 Pa

Potential Applications

Heatshield and backshell TPS